London Ambulance Service NHS Trust

Cardiac Arrest Annual Report: 2007/08

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Introduction

During the period 1st April 2007 to 31st March 2008, the London Ambulance Service NHS Trust (LAS) attended at total of 10,206 out-of-hospital cardiac arrests. This figure represents an increase of 416 patients compared to last year.

Clinical, operational and demographic information relating to each of these patients was collected and analysed by the Clinical Audit & Research Unit. The information was obtained from Patient Report Forms (PRFs), Mobile Data Terminals (MDTs), FR2 defibrillator data files and Emergency Operations Centre (EOC) records. All patients who were taken to hospital with ongoing resuscitation efforts were traced and their outcomes collected, when possible, from hospital records and national databases.

This report presents figures for the LAS as a whole. More detailed Complex-level information can be found in the Cardiac Care Packs that are produced and disseminated each month by the Clinical Audit & Research Unit.

Cause of Arrest

Of the 10,206 cardiac arrests attended by the LAS, 5,853 (57.4%) were beyond any resuscitation attempt on arrival of the ambulance personnel. LAS crews commenced resuscitation for 4,353 (42.6%) patients. 3,510 (34.4%) patients were resuscitated following a cardiac arrest of a presumed cardiac cause, a further 320 (3.1%) cardiac arrests were related to trauma, and 523 (5.1%) were due to another non-cardiac cause (e.g. terminal illness, respiratory disease or drug overdose).

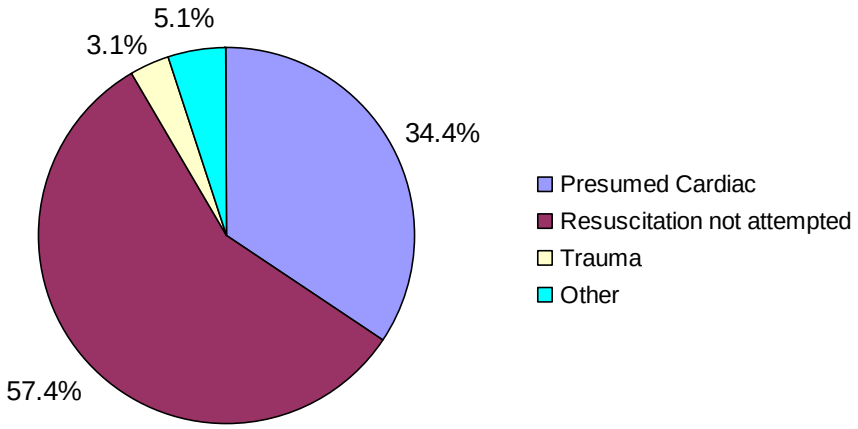


Figure 1. Cause of Arrest

Please Note: the remainder of this report focuses only on patients who were resuscitated following a cardiac arrest of a presumed cardiac cause (n=3,510).

Patient Profile

The average age of the cardiac arrest patient was 66 years (ranging from 0 to 103 years). Age groups are presented in Figure 2 below. The majority of patients were male (64% vs. 36% female). Female cardiac arrest patients tended to be older than males by an average of 5 years (69 vs. 64 years respectively).

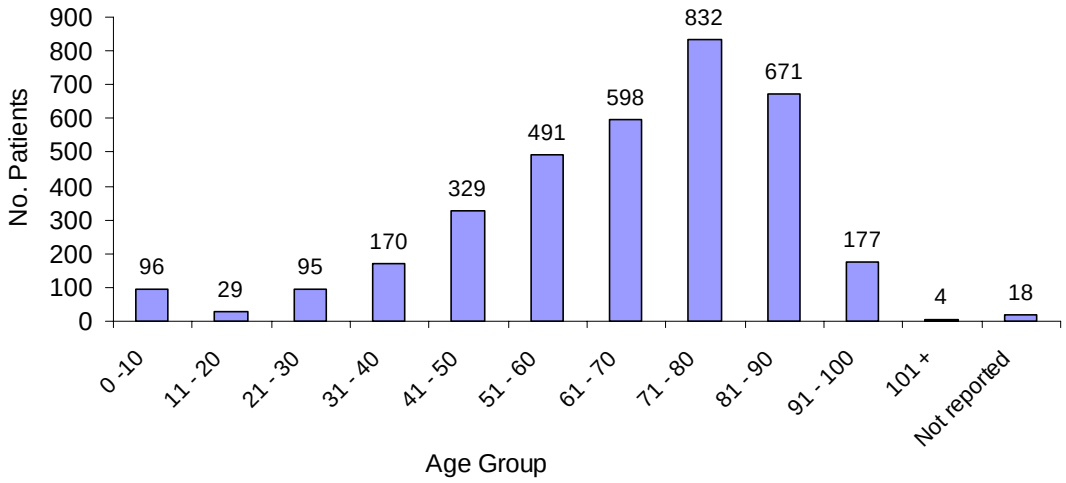


Figure 2. Age Groups of Patients

Day & Month of Arrest

Cardiac arrests occurred most frequently on a Monday (16%; n=566). The highest number of arrests occurred during December (10.2%; n=358) and the fewest in May (6.7%; n=234).

Location of Arrest

The majority of cardiac arrests occurred in a private, residential location (78%; n=2,745), 2,349 of which occurred in the home and 396 in a care home facility. In total, 22% (n=765) of cardiac arrests occurred in a public place. The largest single location for a public cardiac arrest was the street (10.4%; n=365). A further breakdown of cardiac arrest location is provided in Table 1 below.

Location	N	%
Home	2349	67
Work	61	1.7
Street	365	10.4
GP surgery	12	0.3
Care home	396	11.3
Other public	327	9.3

Table 1. Breakdown of location of cardiac arrest

Witnessed Arrest

The majority (43%; n=1,513) of cardiac arrests were witnessed (seen or heard) by a bystander. 15% (n=527) of patients had their arrest witnessed by LAS crews. A further 37% (n=1,294) of cardiac arrests were not witnessed, and for 5% (n=176) of cases it was not reported whether the arrest was witnessed or not.

Bystander CPR

Bystander CPR was attempted in over a third (37%; n=1,283) of cases and, when it was undertaken, it was most frequent when the arrest was bystander witnessed rather than unwitnessed (58% vs. 37%). Bystander CPR was also more likely to occur when the arrest was in a public rather than private location (54% vs. 32%).

Public Access / Community Defibrillation

This year, this section of the report focuses on patients for whom a defibrillator was deployed (regardless of whether a shock was given or not). Twenty-nine patients in total were treated, prior to LAS arrival, by someone with a defibrillator who was trained through the LAS's Community Defibrillation Programme. Eight of these patients survived to hospital discharge. Details of all 29 cases are reported below:

Patient Profile	
Average age	61 (25-84) years
Gender	Male (90%); Female (10%)
Event Information	
Incident location	London Heathrow Airport (17%; n=5) Underground/Mainline train station (48%; n=14) Exhibition/Conference centre (14%; n=4) Other (21%; n=6)
Bystander witnessed	86% (n=25)
Bystander CPR	93% (n=27)
Initial Rhythm (as recorded by public defibrillator)	VF/VT (62%, n=18) Non-shockable (35%, n=10) Unknown (3%, n=1)
Average number (and range) of PAD shocks	1 (0-3) shocks
Return of Spontaneous Circulation (ROSC)	41% (n=12)
Survival Status	
Overall survival	27.6% (n=8/29)
Utstein survival*	38.9% (n=7/18)
Non-survivors	Died in hospital (62.1%; n=18/29) Died on scene (6.9%; n=2/29) Untraceable (3.4%, n=1/29)

** bystander witnessed, VF arrests of presumed cardiac aetiology only*

Table 2. Details of patients for whom a public access defibrillator was deployed

Initial Presenting Rhythm

Almost half of all patients (47%; n=1,655) presented to the ambulance crew with an asystolic heart rhythm. One quarter (25%; n=863) of patients had an initial presenting rhythm of Ventricular Fibrillation (VF) or Ventricular Tachycardia (VT).

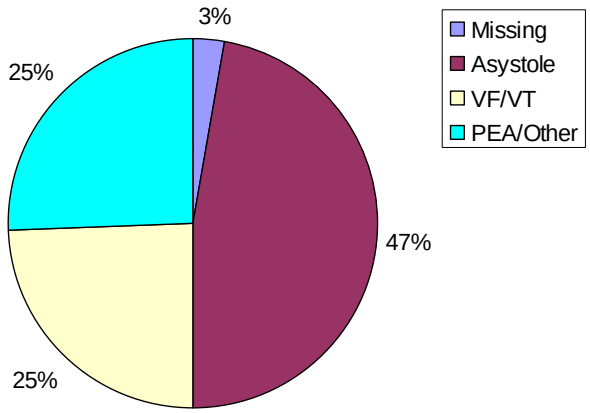


Figure 3. Initial presenting rhythm

Response Times

Ambulance response intervals are shown below. From April 2008, all ambulance services in England adopted 'Call connect' as the 999 call start time; this defines call start as the time the ambulance service receives the emergency call for help. Prior to this date, the LAS used 'Orcon' (the time the patient's location and chief complaint were obtained) to define call start time. To enable both comparisons with previous years and an examination of the impact of changing call start times to Call connect, the table below reports time interval calculations using both Orcon and Call connect definitions.

Time Interval	Average Time (mins.)	Range (mins.)
999 (Orcon)* - Arrival on scene	6	0 - 69
999 (Call connect)** - Arrival on scene	8	0 - 71
999 (Orcon)* - 1st LAS Defibrillation#	9	0 - 34
999 (Call connect)** - 1st LAS Defibrillation#	10	1 - 35
Arrival at scene – 1st LAS Defibrillation#	4	0 - 31
999 (Orcon)* - Arrival at hospital	45	2 - 125
999 (Call connect)** - Arrival at hospital	47	2 – 128
Job cycle (Orcon* - green)	106	6 – 332
Job cycle (Call connect** - green)	108	8 – 332

** Orcon refers to the time that the incident location and the patient's chief complaint were obtained.*

*** Call connect refers to the time that the call was connected to the ambulance service.*

 # Includes only those patients with a non-crew witnessed arrest and an initial rhythm of VF/VT.

Table 3. Response intervals

The average 999 call (Orcon) to arrival on scene interval has remained consistent with last year's figure at 6 minutes. It can be seen in Table 3 that reporting Call connect times instead of Orcon times adds an average of 2 minutes onto response intervals.

Defibrillation intervals (both call to defibrillation and arrival on scene to defibrillation) have also remained relatively consistent with last year. Average job cycle times, however, have increased from 95 to 106 minutes.

Return of Spontaneous Circulation

One quarter of patients (25%; n=869) were reported to have achieved a return of spontaneous circulation (ROSC) at some point during their treatment by the LAS. The majority of these patients collapsed in private (74%, n=639), had a crew or bystander witnessed arrest (70%, n=606) and presented with an initial arrest rhythm of VF/VT (41%; n=360).

When ROSC was achieved (n=869), this was sustained to hospital in 475 (55%) cases. This means that, in total, 13.5% (n= 475/3,510) of patients had a ROSC on arrival at hospital.

Unfortunately, 15% (n=520) of PRFs did not report whether the patient had or had not achieved a ROSC.

Survival Calculations

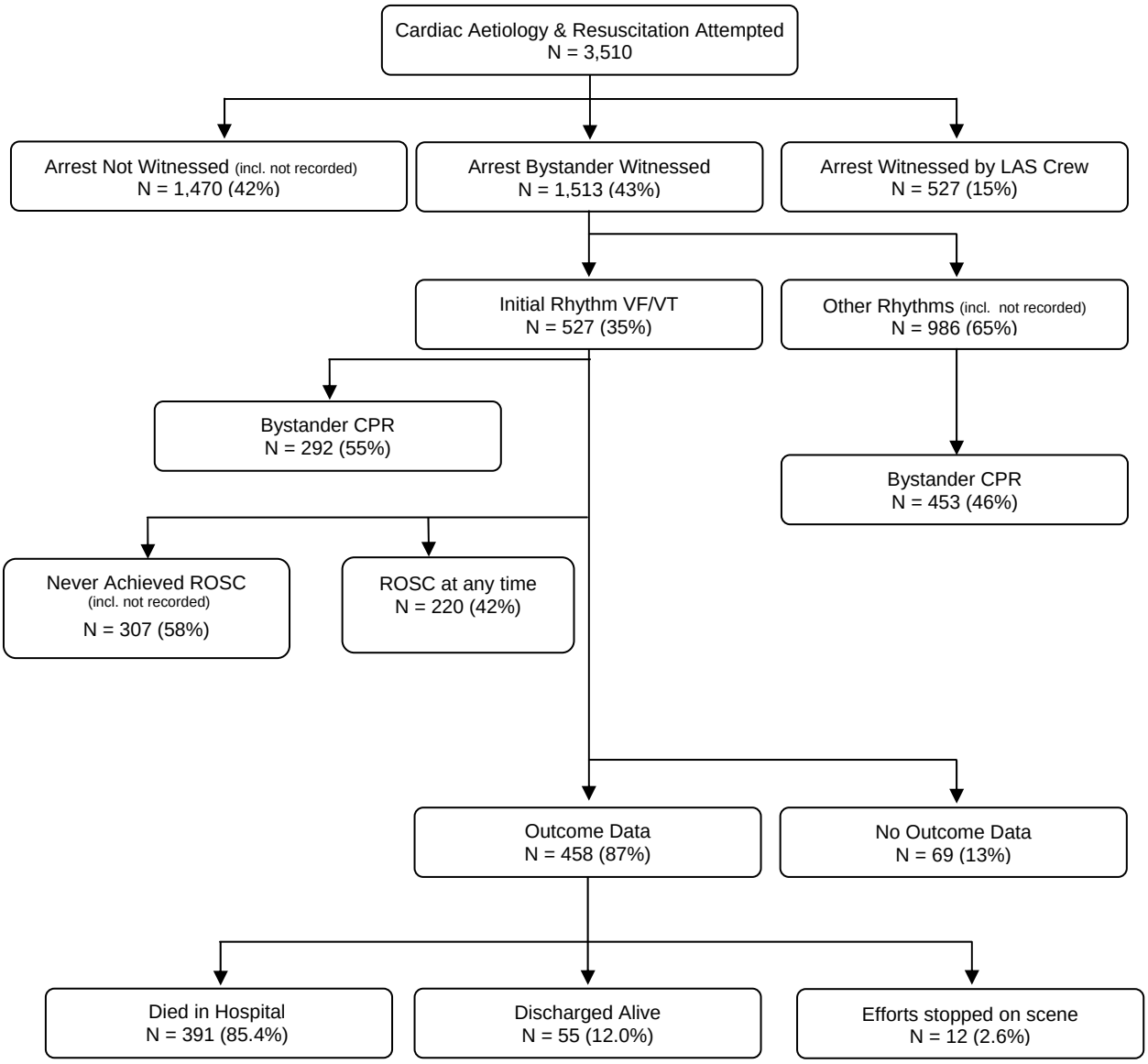
The LAS calculates two survival figures: an Utstein survival rate and an overall survival rate.

Utstein Survival Rate

The Utstein survival calculation[1] is an internationally validated method for calculating out-of-hospital cardiac arrest survival rates that enables comparisons between services. The Utstein calculation is the number of patients discharged alive divided by the number of persons who had resuscitation attempted following a cardiac arrest of a presumed cardiac aetiology, where the arrest was bystander witnessed and the initial rhythm was VF or VT. Patients for whom outcome records could not be traced (n=69) were excluded from the survival analysis. Therefore, the valid denominator for the 2007/08 Utstein survival calculation was 458.

The LAS Utstein survival rate for 2007/08 was 12%. The calculation is illustrated overleaf.

[1] *Cummins RO, Chamberlain DA, Abramson NS et al. Recommended Guidelines for Uniform Reporting of Data from Out-Of-Hospital Cardiac Arrest: The Utstein Style. Annals of Emergency Medicine, 1991; 20: 861-873.*

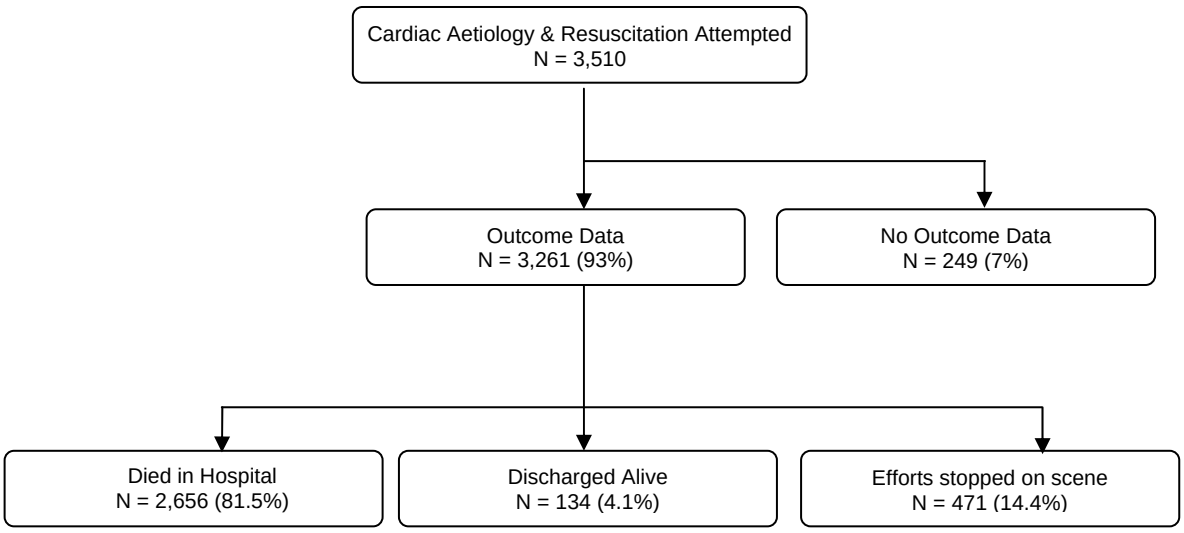


Utstein Survival Rate: (55/458) = 12.0%

Overall Survival Rate

The overall survival rate is based on all patients who had resuscitation commenced by the LAS following an out-of-hospital cardiac arrest of a presumed cardiac cause.

The overall survival rate for 2007/08 was 4.1%.



Overall Survival Rate: (134/3261) = 4.1%

Survival from crew witnessed arrests only

This year, for the first time, this report considers survival from crew witnessed arrests. A total of 527 patients had their collapse witnessed by LAS crews. The outcomes for these patients are presented below. As 52 patients could not be traced to hospital, the valid denominator is 475.

Outcome	N	%
Died on scene	11	2.3
Died in hospital	426	89.7
Discharged alive	38	8.0

Table 4. Breakdown of location of cardiac arrest

When the principles of the Utstein calculation are applied to this particular group of crew witnessed cardiac arrest patients (i.e. the denominator is: crew witnessed, VF arrests of presumed cardiac cause where resuscitation was attempted), the survival rate increases to **28.7%** (n=25/87).

A comparison of survival with ROSC

The chart below plots Utstein survival and ROSC rates against one another and allows comparison over the last 2 years. It is clear to see from the chart that whilst survival to hospital discharge has decreased, our rates of ROSC in the field have increased.

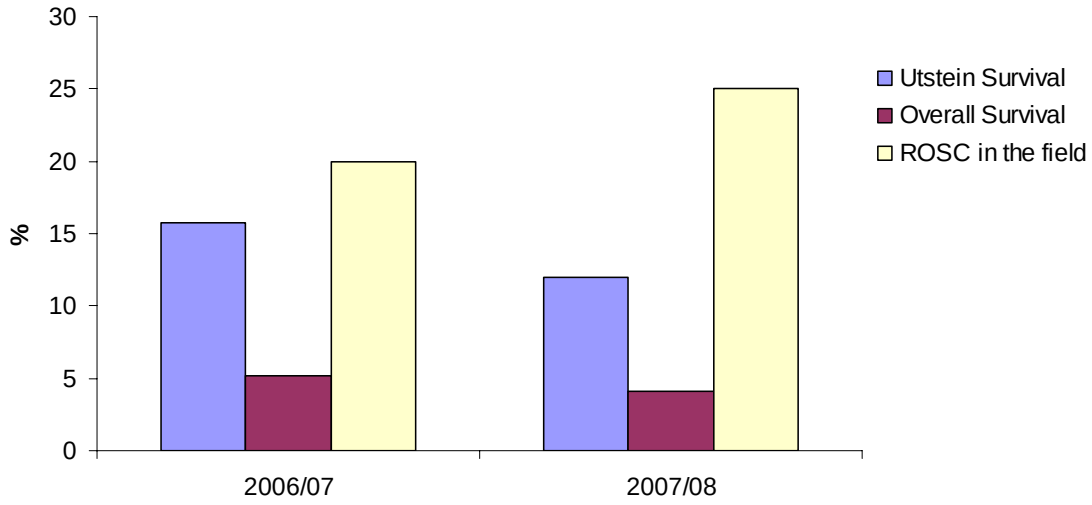


Figure 4. Survival vs. ROSC

Discussion

This year, for the first time, the LAS has experienced a decline in cardiac arrest survival rates compared to the previous year. However, it must be stressed, that whilst the Utstein figure has decreased from last year (15.8% to 12.0%), it is still higher than that reported in 2005/06 (10.9%) and in all other preceding years. The overall survival rate is comparable with that reported in 2004/05 (4.0%).

It is not clear why LAS survival rates have decreased since last year. Compared with last year's annual report, average response times have remained consistent (at 6 minutes), as have defibrillation intervals, rates of witnessed arrests and bystander CPR. The average patient age is also consistent, being only one year younger than last year, and the rate of VF/VT has increased by 3%. However, while the average response times have not changed, it is interesting to note that the range of response times is much longer than last year (increasing from 0-38 minutes to 0-69 minutes). The longer range of response times may have contributed to a poorer outcome.

The question also arises as to whether last year's high survival rate was an anomaly. Unfortunately we will not know the answer to this until we have at least another couple of year's worth of data to allow us to identify the longer term trends.

Whilst survival to hospital discharge has decreased, we have been more successful in gaining a return of spontaneous circulation (ROSC) (see Figure 4). This year 25% of patients (who were resuscitated following a cardiac arrest of a presumed cardiac cause) were reported to have achieved ROSC at some point during their treatment by the LAS. Last year the figure was 20%. Furthermore, of those who achieved ROSC in the field, 55% managed to sustain it to arrival at hospital. The level of ROSC may, in reality, be higher, but unfortunately 15% of PRFs (relating to 520 patients) did not contain documentation of whether ROSC was achieved or not. Our ROSC rates demonstrate that our care of cardiac patients is improving and contributing to a better outcome out of hospital – although this is not reflected in the number of patients that leave hospital alive. Given the increase in ROSC since last year, it is possible that the decline in survival has little to do with our cardiac care, but may simply be a reflection of the patient population and their co-morbidities, or have something to do with post resuscitation care at hospital.

Our findings support the argument for the implementation of new and alternative cardiac resuscitative techniques known to have a survival impact on patients with a ROSC, such as therapeutic hypothermia. The findings also support the notion of directly transferring patients with a sustained ROSC to designated specialist hospitals.

This year we have reported separately on survival from crew witnessed cardiac arrests. As would be expected in line with the 'chain of survival concept', the survival figure for this subgroup of patients is far higher than for other groups of patients (8.0% overall and 28.7% Utstein). Some organisations include routinely crew witnessed arrests as part of their overall Utstein calculation (as opposed to filtering through the template focusing on bystander witnessed arrests only). Doing so ensures that they capture the impact of immediate advanced life support on outcomes. This is something that the LAS may wish to consider in future when calculating Utstein survival figures.

All things considered, whilst the rate of survival to hospital discharge has declined compared to last year, we should still be proud of the care that we delivered to cardiac arrest patients this year and be confident that we are continuing to achieve good outcomes for our patients.